

Nelson Biology VCE Units 1 & 2

Answers to Chapter Questions

Chapter 2

Review questions

- 1 Organic: lipid, protein, carbohydrate, nucleic acid. Inorganic: water, minerals, carbon dioxide.
- 2 Scientists use biochemical tests. See Table 2.1 for the tests.
- 3 Requirements such as oxygen and glucose need to move into a cell across the plasma membrane in order to maintain cellular respiration. Waste products such as carbon dioxide and excess water must leave a cell, passing through the plasma membrane. Cellular processes require different inputs and produce different wastes and products.
- 4
 - a Phospholipids
 - b Cholesterol
 - c Phospholipids
- 5 Fats are solid at room temperature and oils are liquid.
- 6 Because they contain **three (tri-)** fatty acids and one glycerol.
- 7 Chips are normally cooked in a saturated fat such as lard because these fats are less likely to break down at the high temperatures required for frying chips. On the other hand, an unsaturated fat such as sunflower oil will break down at relatively low temperatures, so that it breaks down before the chips are fully cooked.
- 8 It is important to include some fat in your diet because many important vitamins need fats to aid their absorption into your body.
- 9 Fat-soluble vitamins are stored within your fatty tissue. If too many of these vitamins are eaten, they can accumulate to harmful levels. An example of this occurred when Xavier Mertz (see Biobox 2.1) ate too many husky livers, causing him to die of vitamin A toxicity.
- 10 Iron, copper and nickel deficiency would cause anaemia. This reduces the amount of haemoglobin in the blood. As oxygen joins to haemoglobin in red blood cells, there would be less oxygen available for cells. Lethargy is the main symptom of anaemia.
- 11 Vitamins: E, B1, B2, B3, B6, biotin
Minerals: potassium, calcium, phosphorus, magnesium, iron, copper, zinc, selenium, chromium, nickel, silicon, manganese, molybdenum
- 12 The student is to draw their own concept map. It should include ideas such as polypeptides being made of amino acids, which are composed of carbon, hydrogen, oxygen, nitrogen and sometimes sulfur, phosphorus and other elements. Eight of the essential amino acids cannot be made by our bodies and so must be included in our diet.

- 13** Without enzymes, reactions in cells would occur so slowly, they would hardly proceed at all. This would be incompatible with the maintenance of life.
- 14** There are thousands of different reactions occurring in the human body. Each reaction requires a different enzyme, hence the need for the thousands of different types of enzymes.
- 15** Intracellular enzymes occur inside cells, speeding up metabolic reactions. Extracellular enzymes are produced by cells, but achieve their effects outside the cell.
- 16**
- a** They act very rapidly. The lock-and-key mechanism explains this because the enzyme-substrate complex causes the substrate to change, producing the end product.
 - b** They are not destroyed or altered by the reactions they catalyse; they can be used again. The lock-and-key mechanism explains this because the substrate fits into the enzyme active site, then leaves it. The active site remains intact after the substrate leaves.
 - c** They can work in either direction. The lock-and-key mechanism explains this because the substrate molecule attaches to the enzyme.
 - d** They are affected by temperature and have an optimal range in which they operate. The lock-and-key mechanism explains this because the active site shape changes when the temperature changes.
 - e** They are sensitive to pH. The lock-and-key mechanism explains this because the active site shape changes when the pH changes.
 - f** They are usually specific to particular reactions. The lock-and-key mechanism explains this because each enzyme has a specific shape that fits closely with the substrate.
- 17** If our body temperature increases, enzymes change shape. If they change to such an extent that they are no longer able to function, important reactions in our body may not proceed at a fast enough rate to maintain life.
- 18** The student is to draw their own concept map. The following things should be included:
- Chemical composition of carbohydrates: carbon, hydrogen, oxygen.
 - Production of carbohydrates: role of photosynthesis in building up glucose molecules.
 - Building up carbohydrates: joining monosaccharides together to form disaccharides and polysaccharides; types of polysaccharides such as cellulose, starch and glycogen.
 - Breaking down of carbohydrates: cellular respiration.
- 19** Excess carbohydrate is stored as glycogen in animals and starch in plants.
- 20** The prokaryotic cell wall is composed of peptidoglycan, which is composed of polysaccharides and protein. A jelly-like capsule sometimes surrounds the cell wall. It is composed of polysaccharides and sometimes protein.
- 21** If the water in a cell decreases too much, organelles will not be able to move around. This means they will be deprived of requirements and the removal of wastes. The amounts of products of organelles will be reduced severely. Another reason why the cell might die is because chemical activity within the cell is reduced. This is because many chemical reactions require water as part of their reactants.

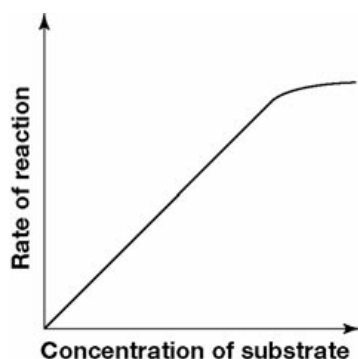
- 22 Salts and simple sugars dissolve readily in the water in the cytoplasm. Proteins, lipids and other large organic molecules are found suspended in the cytoplasm because they do not readily dissolve in water.
- 23 Enzymes function efficiently within a narrow temperature range. Water helps keep the temperature of cells fairly stable so that enzymes are working at their optimal temperature. Enzyme activity takes place in an aqueous solution, hence another need for water.
- 24 When actin molecules join together they form filaments or tubes. These provide the cell with structure and strength. Some cells need to be flexible. In this case, the cytoskeleton needs to be disassembled, then reformed. Actin molecules are capable of performing this function.
- 25 Energy released from glucose is stored temporarily in ATP before it is utilised by the cell.
- 26 The cristae (infolded projections in the mitochondria) increase the surface area and hence the space for enzymes to work. This increases the efficiency of mitochondrial enzymes.
- 27 Endoplasmic reticulum is made of phospholipids. Rough endoplasmic reticulum is studded with ribosomes and so would have ribosomal RNA and proteins. Smooth endoplasmic reticulum has no ribosomes and produces lipids and fats.
- 28 DNA is found in the nucleus of a eukaryotic cell. Some is also found in mitochondria and chloroplasts. RNA is found in both the nucleus and cytoplasm. In prokaryotic cells, DNA and RNA are found in the cytoplasm as there is no clearly defined nucleus.
- 29 There are four nucleotide bases (adenine, guanine, cytosine and thymine) in DNA. The order of these bases varies and so they are suitable for use as a chemical code.
- 30 Chlorophyll absorbs different wavelengths of light compared to carotenoids. When both are present, there is a larger range of the light spectrum available for absorption and hence photosynthesis.
- 31 Cells produce materials that are non-living, such as hair, nails and wax. These are part of a living organism although they are non-cellular. Hence, living things are made up of cells and the products of cells.

Apply understandings

- 1 Fatty acids and glycerol – lipids – steroids
Amino acids – polypeptide – keratin
Glucose – polysaccharide – cellulose
- 2
- a Monosaccharides are composed of one sugar unit.
Disaccharides are composed of two sugar units.
Polysaccharides are composed of many sugar units.
 - b An enzyme joins with a substrate and after some time the product is formed.
 - c Organic compounds contain complex carbon-containing molecules. All other compounds are inorganic.
 - d Saturated fat is made of fatty acids containing only single bonds between carbon atoms whereas unsaturated fat has double bonds between some carbon atoms. Saturated fats are not easily broken down by cells in your body, whereas unsaturated fat is more easily broken down.

- 3 Both are eukaryotic cells (although potato is a plant cell and liver is an animal cell), they are composed of the same organic and inorganic molecules (although in different proportions) and enzymes control the metabolism of both cells (although there are different types of enzymes). Students could have alternative answers here.
- 4 This is not good advice as lipids are important in the absorption of vitamins, are key components in cell membranes and act as raw materials for hormone synthesis.
- 5 Enzymes work efficiently within a narrow range of pH. If the pH varies, enzyme function is restricted. It is therefore important to keep the surroundings of cells at an optimum pH for enzyme function.
- 6 a The amount of enzyme is the factor limiting the rate of the reaction. When there are no more active sites available, the rate of reaction cannot increase any more.

b



As more active sites become available, due to the doubling of the amount of enzyme, the rate of reaction will increase. Only when the active sites are all used or the concentration of substrate declines will the rate of reaction plateau or begin to fall.

Investigate and inquire

- 1 Anaesthetics are likely to be lipid-soluble and therefore can move straight through the lipid section of the plasma membrane. This is much quicker as the anaesthetic does not have to manoeuvre its way through the protein channels.
- 2 Some organisms contain enzymes that are stable and do not denature at high temperatures. These enzymes have additional covalent (disulfide) links between non-adjacent amino acids; these help to make the structure more rigid.